Understanding Chemolithotrophic Reduction Mechanisms from the Dark Marine Biosphere (DMB)

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Research Objective: To better understand natural carbonate reduction mechanisms by identifying carbonate-reducing members of a consortia to develop adaptive systems engineered around biofilms

Motivation

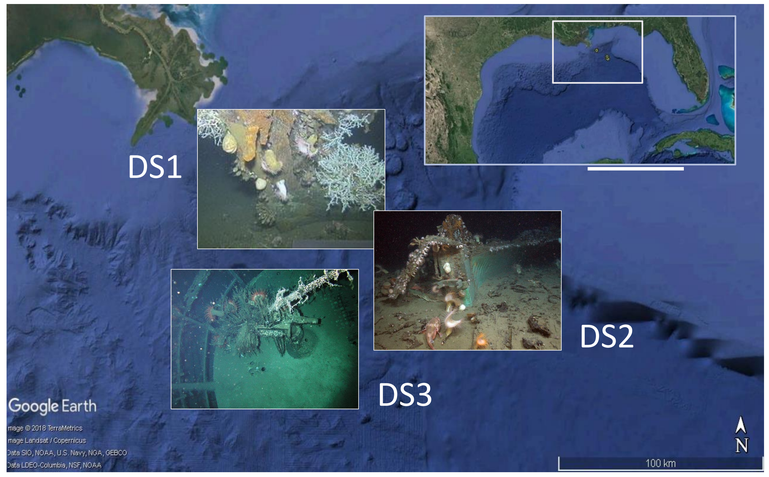
- Since the beginning of the Industrial Revolution, levels of ocean acidity have increased by 26%[1]
- Current acidity today exceeds previously experienced natural variability[1]

Mapping this project onto the UN Sustainable Development Goals[2]

- **14.3** Minimize and address the impacts of ocean acidification, including through enhanced scientific cooperation
- **13.3** Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning

Methodology

- Sediment samples taken from defined sites in the Gulf of Mexico
- Cultured anaerobically in selective media with defined N/C content
- Ion chromatography used to measure bicarbonate consumption and acetate production



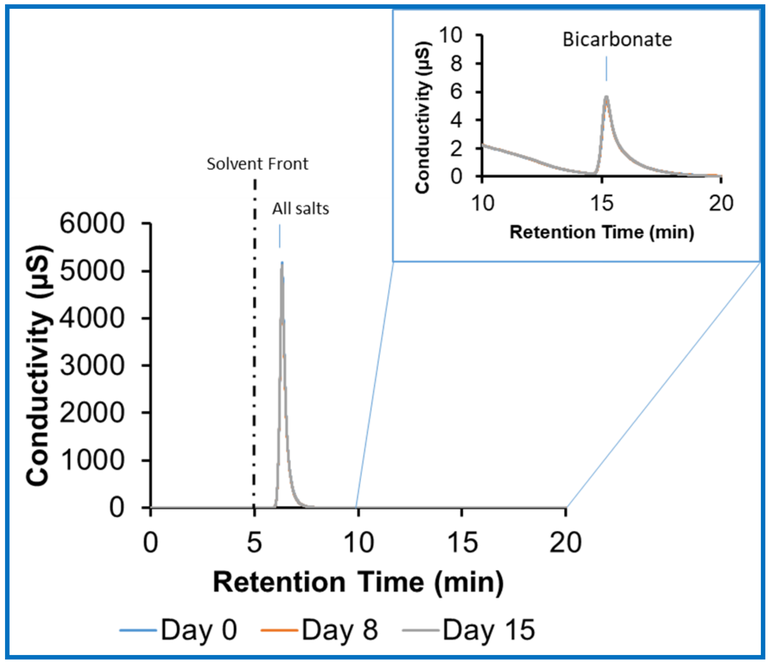
Map showing where sediment samples were taken. Inset photos show actual collection sites.

References

[1] Guterrez, A. (2018). The Sustainable Development Goals report 2018.

[2] Inter-Agency and Expert Group on SDG Indicators. (2016, March). Global indicator framework for the Sustainable Development Goals and targets of the 2030 Agenda for Sustainable Development.

Results



Example of ion chromatography. Peak at retention time 15 minutes correlates to [HCO_3^-]. As microbes consume HCO_3^-, area under the curve decreases, showing carbonate consumption.

Conclusions & Next Steps

- By selectively pressuring environmental consortia from the DMB toward carbon fixation, mechanisms can be generated to control CO_2
- Begin long-term growth experiments to monitor changes in consortia dynamics with regard to carbonate fixation rates